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AT the great Mount Wilson Observatory, in Southern California, work on the world's greatest telescope is approaching completion.

Its principal feature is its gigantic 100-inch reflector.

The construction of this great instrument is a matter of first importance not only to the scientific world, but to the world of the average man. This new mechanism will extend greatly our vision into space; it is actually a pioneer into uncharted regions, full of enormous possibilities of adding to the total of human knowledge.

With it we may expect, according to the astronomers who will have charge of it, to see 100,000,000 new stars or "suns," to learn the cause of the colors of the stars and, perhaps, to ascertain the limits of our universe.

Professor George Ellery Hale, who has charge of the observatory and will direct the researches to be undertaken with the giant reflector, has furnished some very interesting information to this newspaper, both concerning the construction of the instrument and the work which it is expected to do with it.

"The process of making the mirror is a long and interesting one," said Professor Hale. "The mirror serves only as a support for a thin silver coating deposited chemically on the front surface, and the light is reflected from this silvered surface without entering

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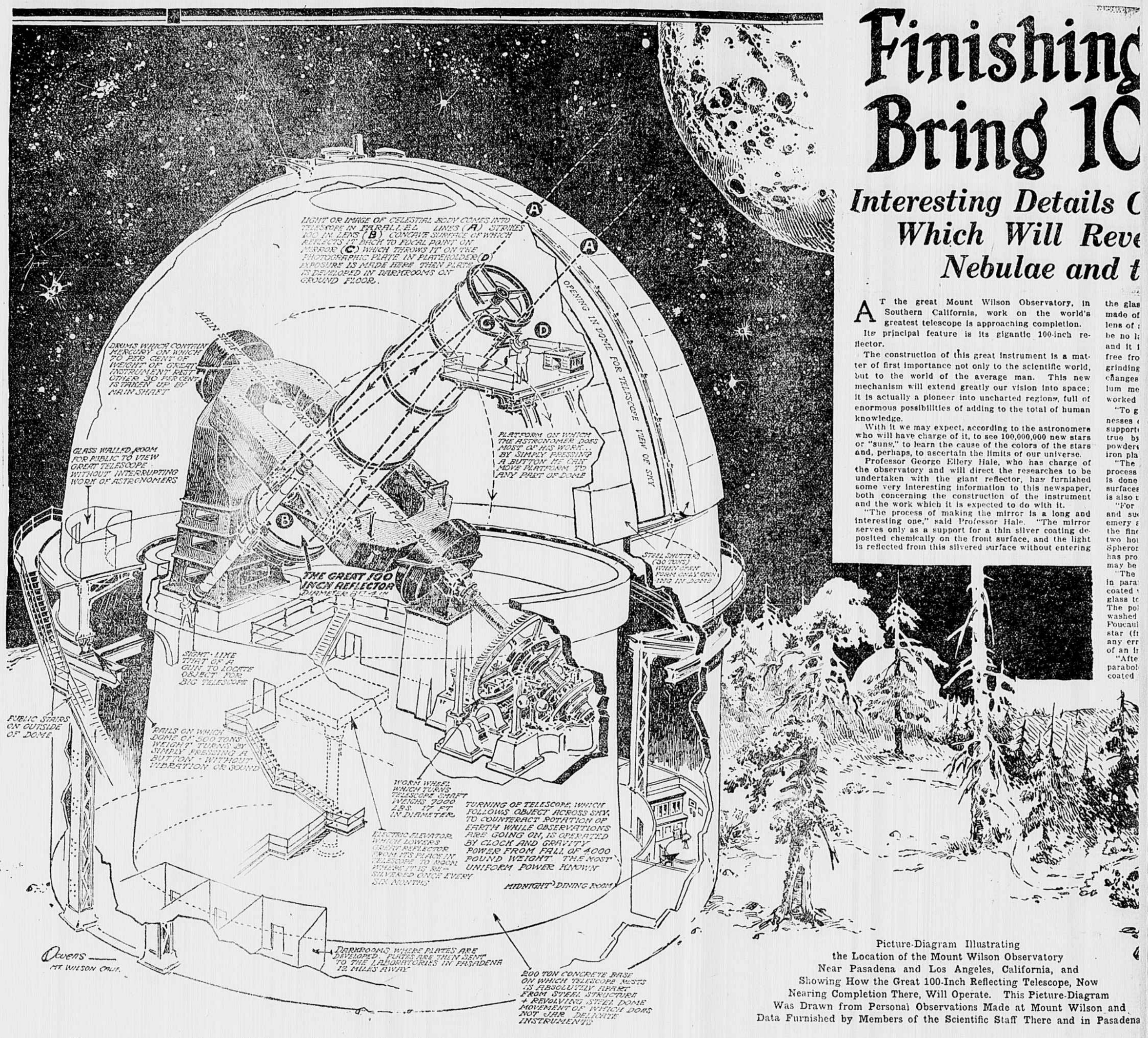

Picture-Diagram Illustrating the Location of the Mount Wilson Observatory Near Pasadena and Los Angeles, California, and Showing How the Great 100-Inch Reflecting Telescope, Now Nearing Completion There, Will Operate. This Picture-Diagram Was Drawn from Personal Observations Made at Mount Wilson and Data Furnished by Members of the Scientific Staff There and in Pasadena

Some of the Wonderful Things That May or Might Be Revealed by the 100-I

By Prof. Garrett P. Serviss

TO my mind the most interesting possibility of the 100-inch telescope at Mount Wilson Observatory is that it will probably signalize the practical attainment of the boundaries of the universe.

It is doubtful if any star giving forth a radiation sensible to the human eye, or to the photographic plate, exists at a distance beyond the reach of this gigantic instrument. The manner in which the relative number of very remote stars revealed by the great telescopes hitherto used falls off with continued increase of distance has long been a clear indication that the limits of the starry system were being approached, but up to the present time telescopes have been unable actually to reach those limits. There are evidently stars beyond their range, but it is equally evident that these outliers thin out like the scattered trees bordering a forest or the dispersed particles around a cloud of dust, and the 100-inch telescope, in all probability, will range through them to the starless spaces outside.

The suggestion that the thinning out of the stars at extreme distances is due to obstruction of light in space may possibly have a sound basis, but its validity remains to be proved. It is far more probable that what we call the universe is a system consisting of many hundred millions of stars, which has boundaries on all sides, and is separated from other similar systems by expanses of space so vast, or so constituted, that no sensible radiations can cross them. As long as it is governed by ordinary geometrical principles, the mind is unable to set a limit to space itself, but it can easily conceive of an indefinite number of starry universes, floating, so to speak, in open space as swarms of phosphorescent animalculae float in the ocean.

The 100-inch telescope may show us the limits of our particular swarm. It will then render possible the calculation of a census of the starry system, or "universe," in which we live, and it may settle the question whether certain strangely organized nebulous clouds, like that in Andromeda, really belong to our system, or are, as some have suspected, outlying universes which happen to be near enough to glimmer into view.

While the astronomer readily comprehends the "space-penetrating power" of a telescope by considering the "magnitude" of the faintest stars that it can reveal, it is easier for the layman to understand the matter if distance instead of magnitude is made the basis of comparison. How far can the greatest telescope now in commission see into space, and how much further will the the 100-inch instrument penetrate? Some assumptions must necessarily be made in attempting to answer this question, and the most important is this: It is assumed that, taking the stars by wholesale, and disregarding individuals, the fainter they are the greater is their mean distance. There are many exceptions to this rule, but in a broad sense it may be applied.

Now, the 60-inch telescope at Mount Wilson shows stars down to the twenty-first magnitude (which are 100,000,000 times fainter than first magnitude stars), and the 100-inch, gathering nearly three times as much light, will show stars at least one magnitude lower, since, in the descending scale, each magnitude is about two and a half times less bright than the next above it. But the brightness of a star varies inversely as the square of its distance; so, if we wish to know how much further away the stars shown by the 100-inch are than those shown by the 60-inch, which are one magnitude, or two and a half times brighter, we take the square root of 2½, which is about 1.58, and this shows us that the distances are as 1.58 to 1, or, in round numbers, the 100-inch will show stars 60 per cent further away than those reached by the 60-inch.

No certain estimates of these distances, in terrestrial standards, can be made, but it is usual to take the "light-year"—the distance light would go in one year—as a unit. If we assume that the faintest stars seen with the 60-inch are 45,000 light-years away, then the 100-inch should show stars, if they exist, that are 72,000 light-years away. A light-year is about 5,800,000,000,000 miles. In other words, we may say that the new giant will expand the telescopic boundaries about 156,000 trillions miles on every side beyond their present limits!

An authoritative statement of some of the things that may be expected of the new telescope and of the investigations to which its matchless powers will be applied, is presented in the interview with Professor George E. Hale, the director of the Mount Wilson Observatory. The work carried on at that observatory is the most important astronomical work now being done on the earth, and its results will be enormously enhanced in value by bringing the new instrument into action. One can only regret that there is no prospect of the making of half a dozen similar telescopes in order that all the different branches of investigation that might be advanced by them could be undertaken simultaneously.

There are a thousand questions which everybody would like to have answered, which must await their turn. Beside the problems of the extent of the universe and of its form, there are those presented by the wonderful spiral nebulae, which glimmer like geometrical cobwebs sparkling with dewdrops, in many dark parts of the sky, and whose shapes suggest that they are spinning like pin-wheels and throwing off half formed suns in streams and coils of fire. These are best revealed by photography, and the immense light-grasping power of the new telescope, which, by the law of areas, is a quarter of a million times greater than that of the unaided human eye, should enable it to present these marvellous objects with a clearness and detail far beyond everything that has yet been accomplished.

Some of these extraordinary objects, as shown in existing photographs, are complete nondescripts, so bizarre in appearance that it seems impossible to account for their origin by any law of stellar evolution yet suggested. They are as fantastic as the gleaming shapes which you may have seen in a drop of water with the aid of a high-power microscope. In many cases their widely extending tentacles stretch away for billions of miles, stringing stars and starry knots together in the most amazing fashion. To see these things with a power of vision nearly three times as great as the greatest yet applied cannot but result in revelations that will astonish the astronomers themselves. There are some who think that the secret of the origin of suns and worlds is locked up in the mysterious spiral nebulae. It is good news that the giant telescope will be turned in their direction.

Many of the most important astronomical investigations depend upon analysis of the rays of light coming from the celestial bodies. At Mount Wilson very large and elaborate appliances exist for this work. A beam of light from a star is there handled almost as if it were a material object. It is received as a precious visitor from space, bringing inestimable knowledge that can be abstracted from it. It is treated with astonishing care. The air is steadied for its passage and kept at a uniform temperature, in order that the delicate ray may suffer no disturbance.

It is examined with instruments of amazing precision and manipulated and "painlessly" dissected with more than surgical skill. Photographs are made of it in what may, for illustration's sake, be called its dissected state. And finally there is extracted from it a surprising amount of information about the composition and condition of the body from which it comes. Now, many of the most interesting stars are so far away and so faint that their beams are too dim to be treated in this way, but when a giant telescope grasps a whole sheaf of the rays the affair becomes relatively easy, and the greater the power of the telescope the profounder its range into the star deeps.

The program already laid out for the monster telescope is so great and important that there seems to be no chance that it can be devoted to the study of bodies nearer to us than the stars and nebulae. But, if it could be applied—and perhaps some enlightened